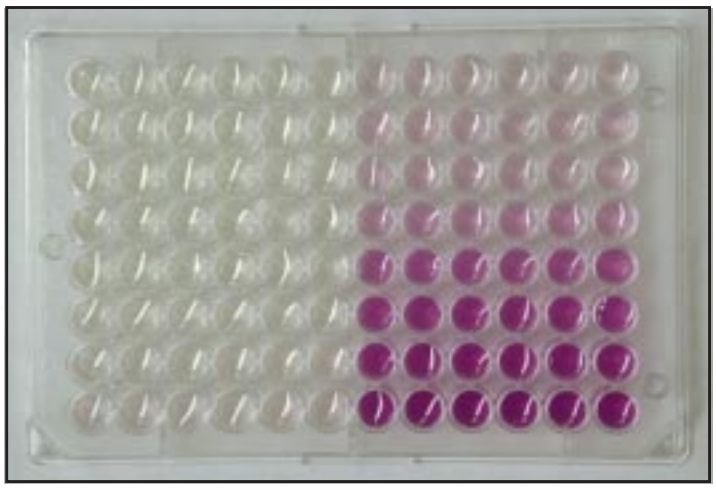
BIOLOGICAL REDUCTION OF METALS

Chromate — a highly toxic, carcinogenic and very soluble form of the heavy metal chromium — is a contaminant in almost one-third of the nation's Superfund sites. It moves easily through groundwater from industrial sources, such as metal plating plants, tanneries, and wastewater treatment sites. The current clean-up method is extremely costly. It requires drilling wells to pump groundwater to the surface, and using chemical reduction followed by physical separation to produce a benign form of chromium.



Researchers from the Idaho National Engineering and Environmental Laboratory and the Center for Multiphase Environmental Research at Washington State University are developing a method that uses naturally occurring bacteria to reduce chromate to nearly undetectable levels. They anticipate the cost of this method may be 10 to 100 times less expensive than current remediation technology.

Although the microbes prefer to metabolize nitrate, the scientists were able to trick the bacteria into changing chromate to trivalent chromium, a more benign form of the metal and a trace nutrient for humans.

The scientists collected bacteria from several chromate-contaminated sites, including the U.S. Department of Energy's Superfund site at Hanford, Washington. They can grow the bacteria in a variety of conditions using inexpensive substances like molasses as food. The researchers suspect that the bacteria chemically reduce chromate with an enzyme they normally use to reduce nitrate.

With a three-year grant from the U.S. Department of Energy Natural and Accelerated Bioremediation Research program, the researchers plan to identify the precise growth conditions that induce bacteria to reduce chromate, and the effect of relative concentrations of chromate and nitrate on their metabolism. They will also explore the effect of other heavy metals, such as uranium and technetium, and map the biochemical pathway bacteria use to convert chromate to trivalent chromium.

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INEEL researchers believe this approach shows great promise to clean up contaminated sites as well as prevent further pollution. They plan to develop a low cost, low technology, worker friendly method to remove chromate in place. Instead of pumping water out of the ground and treating it, cleanup crews would drill a few wells, inject nutrients for the bacteria, and leave them to do their job. In addition, this technology can be applied to treating wastewater before it moves into the environment.

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